Outcomes of Endurance Training for a 76 Year-Old Male with Hospital Acquired Pneumonia and Elevated Troponin Levels: A Case Report

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OUTCOMES OF ENDURANCE TRAINING FOR A 76 YEAR-OLD MALE WITH HOSPITAL ACQUIRED PNEUMONIA AND ELEVATED TROPONIN LEVELS: A CASE REPORT

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ABSTRACT
Background/Purpose: The purpose of this case report is to describe the interventions that were implemented for a patient with hospital-acquired pneumonia with multiple co-morbidities.
Case Description: The patient was a 76 year old Caucasian male who was status-post 3.5 weeks in acute care and 11 days in the ICU secondary to hospital-acquired pneumonia and elevated troponin levels. The patient presented with decreased lower extremity strength, impaired balance, and difficulty with bed mobility, transfers and gait. The patient underwent endurance training and weaning of supplemental oxygen to return to prior level of function. Assessments were performed on a weekly basis. Outcome measures included the Tinetti Balance Assessment and the 30 Second Sit-to-Stand test.
Outcomes: Upon completion of physical therapy, the patient improved bilateral lower extremity strength, balance and gait. Tinetti Balance Assessment scores increased by 1 point from week 3 to week 5 and the 30 Second Sit-to-Stand test showed an increase from 6 successful transitions to 9 from week 2 to 3. At the termination of PT the patient was able to return home independent in self-care and ambulating with a 4-wheeled rolling walker.
Discussion: This case report demonstrated that it is possible to improve the functional independence in male older adults with complex medical issues, which have had a diagnosis of hospital-acquired pneumonia. Future research should focus on comparing the energy expenditure of utilizing a rolling walker versus a 4-wheeled walker.

INTRODUCTION

Acute lower respiratory infections of the lungs, also known as pneumonia, are a primary source of morbidity and mortality in older adults.[1] Pneumonia can be classified into two main subcategories, such as community-acquired pneumonia or healthcare-associated pneumonia. Health-care associated pneumonia is transmitted during a hospitalization and differentiated into either ventilator-associated pneumonia or hospital-acquired pneumonia.[1] Hospital-acquired pneumonia incidence ranges from five to greater than 20 cases per 1000 hospital admissions.[2-4] Approximately one-third of cases of hospital-acquired pneumonia are ICU-acquired, with ventilator-associated pneumonia accounting for 90% of cases.[2] Nonventilator-associated pneumonia dramatically increases both the hospital length of stay and cost of care, and is associated with an overall mortality of 27-51%.[2,3]

Health-care acquired pneumonia has been shown to have a twice as long hospital stay, higher mortality rate, and a more severe comorbidity status in comparison to community-acquired pneumonia.[1] The mortality rate of hospital-acquired pneumonia is 6-9%, but varies from 3-17% depending on patient subgroups.[2] Casini *et al.* found that in patients 65 and older, hospital-acquired pneumonia is seen in patients within 10 days of residing in a hospital. The highest prevalence of pneumonia was seen in males, ages

75-79, with long-term oxygen therapy the previous year, and that had a diagnosis of COPD or respiratory failure.[1]

Common symptoms of hospital-acquired pneumonia include: changes in mental status or confusion, cough with pus-like phlegm, fever and chills, malaise, loss of appetite, nausea and vomiting, sharp chest pain, shortness of breath, decreased blood pressure, and high heart rate.[5] Patients that are more prone to contracting pneumonia in a hospital have one or more of the following characteristics: alcoholism, chest surgery or other major surgery, a weak immune system, chronic lung disease, breathe saliva or food into their lungs, or are older.[5] Current research that is available for hospital-acquired pneumonia involves prevention and medical treatment techniques. There is limited research on interventions to manage or rehabilitate patients with hospital-acquired pneumonia. The purpose of this case report is to describe the interventions that were implemented for a patient with hospital-acquired pneumonia with multiple co-morbidities.

Cardiac troponin levels are normally so low they cannot be detected with most blood tests.[6] The normal lab value for troponin varies among testing laboratories. However, a slight increase in the troponin level will often mean there has been some damage to the heart, and very high levels are a sign that a myocardial infarction has occurred.[6] Increased troponin levels may also be due to any of the following: abnormally fast heart beat, hypertension, pulmonary embolus, congestive heart failure, myocarditis, long-tern kidney disease, cardiomyopathy, trauma or injury to the heart, or prolonged exercise.[6]

Cardiac troponin testing is the biomarker gold standard for the diagnosis of acute myocardial infarction (MI).[7] However, elevation of troponin may occur in acute coronary ischemia, such as chronic heart failure (CHF).[7] The cardinal symptoms of CHF include chronic fatigue, exercise intolerance, and shortness of breath.[8] Unfortunately, clinicians are challenged with the low participation and adherence to the exercise programs.[8] Exercise training programs for patients with CHF are safe and beneficial in improving exercise capacity, exercise duration, parameters of submaximal exercise performance, and improve quality of life.[8]

SUBJECT

The patient is a 76-year-old Caucasian male that was admitted to an acute care facility with complaints of dyspnea, cough, fatigue and weakness. A chest x-ray was performed one-week after his hospital admission secondary to worsening symptoms, which revealed moderate bibasilar infiltrates. The physician's medical summary noted an unclear etiology. The patient was transferred to the intensive care unit and an endotracheal intubation procedure was performed. Due to chest pain and elevated troponin levels further testing was performed. The patient's troponin levels were 0.08ng/ml, which is indicative of cardiac ischemia. A cardiac catheter procedure showed a blockage of vessels to the heart and as a result a cardiac stent was implanted. The patient was in acute care for 3.5 weeks and in the intensive care unit for 11 days prior to admission into the sub-acute facility. The patient's admitting diagnosis to the sub-acute facility was hospital-acquired pneumonia and elevated troponin levels.

The patient's medical history included conditions of congestive heart failure, coronary artery disease, dyspnea, hypertension, type 2 diabetes, sleep apnea, and depression that made the management of his care more complicated. The patient's surgical history included a spinal fusion of lumbar vertebrae 3 and 4, and total hip arthroplasty. Upon sub-acute initial evaluation the patient presented with decreased strength, impaired sitting and standing balance, and difficulty with transfers and gait. The patient's medication list included the following: Metoproplol tartate, Pantoprazole, Prasugrel, Escitalopram, Bupropion, Insulin glargine, Insulin Human Lispro, Metformin Hcl, hydrocodone, and prednisone. The patient utilized a continuous positive airway pressure (CPAP) at night. Prior to hospitalization the patient was independent in all self-care, and lived with his wife who performed all other household activities. The patient lived in a two-story home with 12 stairs within the home with a handrail on the right side. The patient considered himself a homebound and utilized a straight cane for community ambulation to medical appointments.

SYSTEMS REVIEW

A review of admission screenings of the patient noted typical neuromuscular and integumentary systems. However, the patient's musculoskeletal and cardiopulmonary systems showed atypical findings. Impairments were observed in gross strength, sitting and standing balance, bed mobility, transfers, gait and stairs, endurance, and dyspnea. Based on these findings, the appropriate tests and measures were selected.

TEST AND MEASURES

Range of Motion: Gross range-of-motion measurements were evaluated at initial evaluation in sitting. Range-of-motion (ROM) was categorized as the following: within functional limits (WFL), 75% of ROM, 50% of ROM, 25% of ROM, or <25% of ROM. The patient's gross range-of-motions was deemed WFL for bilateral hip flexion, hip external and internal rotation, knee flexion and extension, and ankle dorsiflexion and plantarflexion. Since ROM at the initial evaluation was WFL no follow-up measurements were performed.

Muscle Strength: Lower-extremity strength was measured with manual muscle testing at the initial examination and then again at week 5 - the discharge session. The patient's lower extremity hip flexion, knee flexion and extension, and ankle plantarflexion and dorsiflexion were tested in sitting.

The grade of the muscle strength was denoted on a 0 - 5 (+/-) scale according to Hislop, *et al.*[9] The lower-extremity strength measurements are shown in Table 1.

Table 1: Results of Strength Testing

Date	**ROM**	**MMT (left / right)**									
		Hip Flx.		**Knee Flx.**		**Knee Ext.**		**PF**		**DF**	
Initial	WFL	3+/5	4-/5	5/5	5/5	5/5	5/5	5/5	5/5	5/5	5/5
D/C	WFL	4/5	4/5	5/5	5/5	5/5	5/5	5/5	5/5	5/5	5/5

Bed Mobility and Transfers: Bed mobility tasks included rolling side-to-side, supine to sit and sit to supine. Functional transfers included bed to/from wheelchair, wheelchair to/from mat table, and wheelchair to/from toilet. The physical therapist student objectively evaluated level of assistance required for bed mobility and transfers at initial evaluation, and weekly thereafter.

The patient's level of assistance was recorded using the following scale that was adapted from Fairchild: dependent (patient requires total physical assistance from one or more persons; special equipment or devices may be used), maximum assist (patient performs 25-49% of the activity), moderate assist (patient performs 50-74% of the activity), minimum assist (patient performs 75% or more of the activity), contact guard assist (CGA: close contact with the patient with physical therapist hands on patient or safety belt), stand-by-assist (SBA: verbal or tactile cues required and close enough to reach patient if needed), supervision (S: verbal cues may be required but no physical assist), modified independent (assistive device or extra time needed), or independent (no verbal or manual assistance needed; no assistive device or extra time needed).[10] A summary of the level of assistance needed for bed mobility and transfers is shown in Table 2.

Table 2: Level of Assistance for Bed Mobility and Transfers

Date	Bed Mobility	Transfers
Initial Evaluation	Moderate assistance	Moderate assistance x2
Week 1 Progress Note	Moderate assistance	Moderate assistance
Week 2 Progress Note	CGA	Minimum assistance
Week 3 Progress Note	CGA	CGA
Week 4 Progress Note	SBA	SBA
Week 5 – Discharge Session	SBA / S	SBA / S

Gait: Observational posture analysis was performed during ambulation throughout the duration of the treatment sessions. Data, which included the average distance ambulated, assistive device used, and level of assistance, was recorded at initial evaluation, and weekly thereafter. According to Bohannon *et al.* distance walked without stopping is an informative, reliable, and responsive measure of gait performance for patients undergoing sub-acute rehabilitation.[11]

The grading scales for bed mobility, transfers, and gait regarding the level of assistance provided by the physical therapist and the patient are widely used tools among acute and sub-acute facilities. There has been little research on the psychometrics regarding the reliability and validity of bed mobility, transfers, and gait assistance grading scales. The assessment of the level of assistance required for the three tasks is very similar to one another. However, these scales are similar to the Functional Independence

Measure (FIM), which is a reliable and valid tool that is used to determine the functional mobility and independence of a patient.[12]

Balance: Static and dynamic sitting and standing balance were objectively evaluated at initial evaluation, and weekly thereafter. Sitting balance was assessed with the patient seated with neither back support nor upper extremity support, and lower extremities touching the ground. Standing balance was assessed with no upper extremity support, but a rolling walker positioned in front of the patient for safety if loss of balance occurred.

Grades for the patient's sitting (static and dynamic) and standing (static and dynamic) balance were given using the following scale that was derived from the O'Sullivan *et al.* Functional Balance Grades: Good (maintains independently, maximum challenges), Good – (maintains independently, moderate challenge), Fair + (maintains independently, minimum challenges), Fair (maintains independently, unable to take challenges), Fair – (maintains balance with contact guard assist), Poor + (maintains balance with minimum assistance), Poor (maintains balance with moderate assistance), Poor – (maintains balance with maximal assistance), Absent (unable to assume position).[13] This grading scale is a commonly used tool among sub-acute facilities, however studies analyzing the psychometrics regarding this grading scale have not been performed.

Tinetti Balance Assessment: The Tinetti balance assessment is a functional measure that is used to evaluate a patient's static posture, dynamic balance, and gait. This tool is used as both a predictive and preventative fall risk measure in older adults. The Tinetti balance assessment is a performance oriented mobility assessment with 9 balance items and 7 gait items that are scored on a 0 to 3-point scale.[14] The balance items included the following: sitting balance, ability to ascend/descend from a chair, immediate standing balance, standing balance (eyes open and eyes closed), standing balance with a nudge to the sternum, and turning 360 degrees.[14] The gait items included the following: initiation of gait, step length, foot clearance, step symmetry and continuity, deviated path, trunk sway, and base of support.[14] The balance score is scored out of a possible 16 points, and the gait score is scored out of a possible 12 points for a total score of 28 combined points. A score of greater than 19 points indicated a "high fall risk," 19-23 points indicated a "medium fall risk," and 24-28 points indicated a "low fall risk."[14]

The Tinetti balance assessment is the most suitable performance measure to evaluate the balance of community-dwelling older adults in comparison to the Timed Up and Go test, One-Leg Stand test, and Functional Reach test.[15] Criterion validity for the Tinetti was (r=0.81), in comparison to Timed Up and Go (r=-0.55) and Functional Reach (r=0.48).[15] Inter-rater and test-retest reliability has an excellent Intra-class Correlation

Coefficient (ICC=.74-.93) for older adults.[16-18] It has a poor ceiling effect (21.25) for the gait portion of the assessment.[16] Intra-rater reliability was considered excellent, including 38.8% for patients that had a stroke and 24.9% for patient's with Parkinson's disease (ICC-0.84).[17] It has excellent sensitivity (93%) to identify fallers.[18] Many items on the Tinetti are difficult to assess on a 2- to 3-point scale and it has poor specificity (only 11% of non-fallers were indentified).[18]

30-Second-Sit-to-Stand: The 30 Second Sit-to-Stand test is a functional measure of lower extremity strength in older adults. The patient is instructed to complete as many sit-to-stand transitions safely within a thirty-second timeframe. Demonstration of the task was provided along with return demonstration by the patient prior to the administration of the test. The height of the hard armless chair was approximately 18 inches. The patient was instructed to sit in the middle of the chair with an upright posture and his feet flat on the floor. On "Go", the patient rose to a full standing position and then down again. The test was modified so that the patient could use bilateral upper extremities to perform the sit-to-stand transition.

Jones *et al.* performed a study of community-dwelling elderly and found that males ages 70-79 years old should be able to complete 12.9 sit-to-stand transitions with a standard deviation of 3.0. Test-retest reliability was excellent (r=0.89) with a confidence interval of 0.79-0.93.[19] Inter-rater reliability is excellent (r = 0.95) with a confidence interval=0.84-0.97).[19]

The 30 Second Sit-to-Stand has 0% floor effects.[19] Excellent criterion validity was seen with the chair stand test compared to weight adjusted performance for all participants: r = 0.77, with a 95% CI = 0.64-0.85.[19] Gill *et al.* performed a study of individuals with osteoarthritis awaiting a joint replacement of the hip or knee and found excellent construct validity in correlation to the 50 feet walk test: ICC = -0.64 (95% CI = -0.75 to -0.49).[20]

SUMMARY OF INITIAL EXAMINATION FINDINGS

According to the Guide to Physical Therapy Practice, de-conditioning as a result of hospital-acquired pneumonia is within the scope of practice for physical therapy.[21] At the time of the initial examination several impairments were identified regarding the patient's strength, endurance, balance, and dyspnea. Manual muscle testing revealed strength impairments in both lower extremities. Assessments of bed mobility, transfers, balance and gait showed high level of assistance required from the physical therapists and nursing staff.

DIAGNOSIS & PROGNOSIS

According to the Guide to Physical Therapy Practice the appropriate practice pattern for this patient is Cardiovascular/Pulmonary 6F: Impaired Ventilation and Respiration/Gas Exchange Associated with Respiratory Failure.[21] Upon initial physical examination, the patient presented with decreased bilateral lower extremity strength, impaired sitting and standing balance, assistance required for bed mobility and transfers, difficulty with stairs and gait, decreased endurance, and dyspnea. These impairments limited the patient's function to perform self-care and ambulation, thus further preventing safe discharge to home. The patient's prognosis was considered good secondary to high motivation to return to his personal home and strong social support from his wife and children.

PLAN OF CARE/GOALS

A patient specific physical therapy intervention program incorporating patient goals was created to improve: bilateral lower extremity strength, sitting and standing balance, assistance required for bed mobility and transfers, gait, ability to ascend/descend stairs, endurance, and to facilitate independent management of dyspnea. Interventions were performed for 60 minutes, 5-6 days per week in a sub-acute facility for 4.5 weeks. The patient attended 24 therapy sessions, missing one session due to a scheduled doctor's appointment outside the facility. The interventions performed on a daily basis are summarized in Table 3. In addition to nursing and physical therapy services, the patient also received occupational therapy 5-6 sessions per week. Home Heath physical therapy was arranged to occur following the patient's self-discharge from the sub-acute facility. The patient left the sub-acute facility prior to the physicians written discharge.

Table 3: Interventions Provided through Course of Treatment

Day	Intervention Number					
	1.	2.	3.	4.	5.	6.
1	x	x	x			
2	---	---	---	---	---	---
3	x	x	x		x	
4	x	x	x		x	
5		x	x			x
6	x				x	x
7	x		x		x	x
8	x		x		x	x
9	x		x		x	
10		x	x		x	x
11		x	x		x	x
12		x	x		x	x
13	x		x		x	x
14	x	x	x		x	x
15		x	x			
16	x	x	x			x
17	x	x	x	x		
18			x			
19	x	x	x	x		
20	x		x		x	
21		x	x		x	x
22	x	x	x	x		
23	x	x	x	x		
24		x	x		x	
D/C	x	x				(HEP)

(--- = patient unable to attend therapy session)

1=Patient education 2=Nustep™ 3=Gait training

4=Stair training 4=Neuromuscular re-education
5=Therapeutic exercise

Patient Education: Patient education was performed periodically throughout the treatment sessions with an emphasis on pursed lip breathing. Pursed lip breathing (PLB) is a breathing strategy that is utilized to reduce dynamic hyperinflation and improve exercise tolerance, improve breathing patterns and arterial oxygenation at submaximal intensity exercise.[22] PLB is indicated for patients with dyspnea at rest and with exertion.

Patient education was also provided regarding how to safely transfer from the bed or chair to the wheelchair, and the wheelchair to the toilet or mat table. Verbal cues provided included safety precautions to engage locking of wheelchair brakes and reach back with both hands to stabilize himself on the arms of the chair prior to sitting.

NuStep™: The NuStep™ is well tolerated by patients with congestive heart failure and common co-morbidities such as back pain, balance difficulties, and lower extremity weakness.[23] The patient utilized the NuStep™ recumbent machine for both lower extremity strength and endurance training. The patient completed 15 minutes of aerobic exercise on the NuStep™ 5-6 times/week. During week 1, the patient exercised on the NuStep™ at resistance level 3 and required a rest break every 5 minutes secondary to feeling fatigued. At weeks 2-4 the patient exercised at resistance level 4. Lastly, at week 5 the patient tolerated 20minutes at resistance level 4.

Gait Training: The patient's progression of distance ambulated is outlined in Graph 1. During weeks 1-3 the patient utilized a rolling walker for ambulation. During week 4, a 4-wheeled rolling walker was introduced following the administration of the Tinetti Balance Assessment, and the patient being categorized as a "low fall risk."

Patient education was provided on how to utilize a rolling walker with a 4-point ambulation pattern described in Fairchild.[10] Verbal cues provided included "step with one foot past the other" to increase step length and "look up and straight ahead" for posture corrections. During week 4, the patient was introduced to a 4-wheeled rolling walker with a safety seat. Utilization of the safety seat for rest breaks was instructed to the patient when feelings of dyspnea or fatigue occur during ambulation.

Stair Training: At week 4, stair training was initiated with a set of 4 steps in the physical therapy gym. Initially, the patient required bilateral use of both handrails in order to ascend and descend the stairs with a step-to pattern and required contact-guard-assist from the physical therapist. By day three of stair training, the patient was able to ascend and descend with a single handrail. However, secondary to the patient's fear of falling, he utilized a side-step pattern using a single handrail on the right side with bilateral upper extremity support. The patient was instructed to ascend the steps leading with the left foot and to descend leading with the right foot, since the handrail at his home is on the right side of the staircase.

Neuromuscular Re-education: Balance training was performed on both non-compliant and compliant surfaces, which included an Airex ® balance pad. Activities performed on non-compliant surfaces with no upper extremity support included single-leg stance, eyes open vs. eyes closed, and high coordination ball catch and toss. Activities performed on compliant surfaces with no upper extremity support included eyes open vs. eyes closed, controlled marching, and tapping a balloon back and forth with a physical therapy technician.

Therapeutic Exercises: The patient performed open kinetic chain exercises in seated and standing positions. The seated exercises included ankle pumps, knee extension, and knee flexion. The standing exercises included toe and heel rises, alternating marching, hip abduction and adduction, and hip extension activities. The patient also performed close kinetic chain exercises (i.e. mini squats). All standing exercises were performed with bilateral upper extremity support at the parallel bars. As endurance training was the specific goal for therapeutic exercises, no ankle weights or resistance bands were utilized.

OUTCOMES

The patient attended 24 of the 25 planned physical therapy sessions. The plan of care entailed one-on-one sessions with a student physical therapist. The Tinetti Balance Assessment was administered to assess the patient's standing balance and mobility while ambulating with a 4-wheeled rolling walker within his private room in the sub-acute facility. Results of the Tinetti yielded a score of 24/28 at week 3, and a score of 25/28 at week 5. A summary of sitting (static and dynamic) and standing (static and dynamic) balance is shown in Table 3.

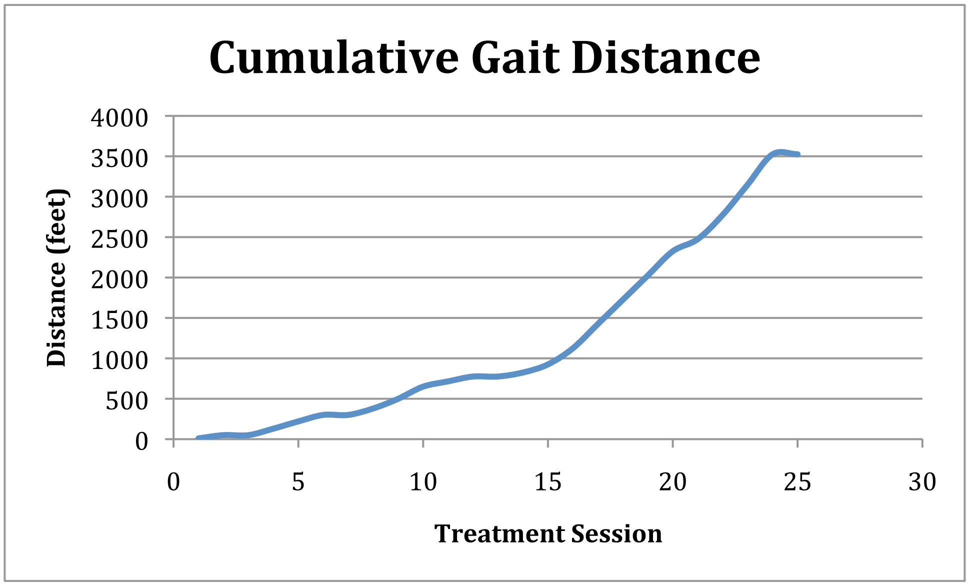
Table 3: Balance Grades

Date	Balance			
	Static Sitting	Dynamic Sitting	Static Standing	Dynamic Standing
Initial Evaluation	Fair	Fair	Poor	Poor
Week 1 Progress	Fair	Fair	Poor	Poor
Week 2 Progress	Fair +	Fair +	Poor +	Poor +
Week 3 Progress	Good	Good	Fair -	Fair - / Poor +
Week 4 Progress	Good -	Good -	Fair +	Fair
Week 5 – D/C	Good -	Good -	Fair +	Fair

At initial evaluation, the patient ambulated 10 feet using a rolling walker with moderate assistance from the physical therapist, and by the end of week 1 the patient ambulated 40 feet using a rolling walker with moderate assistance. By weeks 2 and 3, the patient ambulated 50 feet using a rolling walker with minimum/contact guard assist from the physical therapist. At week 4, the patient ambulated 125 feet using a 4-wheeled rolling walker and by week 5 the patient ambulated 145 feet using a 4-wheeled rolling walker with stand by assistance from the physical therapist.

Distance ambulated by the patient throughout the duration of the treatment session is shown in Figure 1.

Figure 1: Cumulative Distance Ambulated



During week 5 the patient was able to ascend and descend 9 steps in one of the stairwells in the facility with a side-step pattern utilizing a single handrail with stand-by-assist from the physical therapist. The patient's hip flexion strength increased by a half grade from the initial evaluation to the discharge date. Lower extremity strength was functionally measured using the 30 Second Sit-to-Stand test that was assessed when the patient was able to safely perform a sit-to-stand transition with contact-guard assist/stand-by-assistance. At week 2, the patient was able to perform 6 successful sit-to-stand transitions and 9 transitions at week 3.

The patient was admitted to the facility on 2-3 liters of continuous oxygen via nasal cannula and wanted to return home without supplemental oxygen. Nursing approval was required to initiate weaning of supplemental oxygen with close monitoring of oxygen saturation levels (>90% SPO2) during therapeutic activities, therapeutic exercises, and gait and stair training. Oxygen saturation values were recorded throughout the sessions using a finger pulse oximeter. At week 3, the patient was weaned from 2 liters to 1 liter of oxygen during daily therapy sessions with close monitoring of oxygen saturation levels. At week 4, the patient was weaned from 1 liter of oxygen to room air during therapy sessions. The patient's oxygen saturation levels upon exertion remained above 90% SPO2, which allowed for a safe discharge home without supplemental oxygen.

DISCUSSION

The described case study is a unique case related to physical therapy interventions for an older adult that had an extensive hospital stay secondary to hospital-acquired pneumonia. Ambulation distance dramatically increased when comparing weeks 1-3 to weeks 4-5, which may have been associated with a 4-wheeled rolling walker being introduced. At week 3 the patient ambulated approximately 50 feet with a rolling walker compared to week 4 when the patient ambulated approximately 25 feet with a 4-wheeled rolling walker. Foley and Prax found that using a standard walker resulted in higher VO2 and lower ambulation speeds compared to a rolling walker.[24]

Additionally, use of a standard walker versus a rolling walker results in higher rate of perceived exertion (RPEs), higher heart rates, and higher blood pressures.[24] Foley and Prax also found an increase by 104% increase in relative VO2 utilizing a standard walker compared to a rolling walker.[24] Where there has been no research comparing a 4-wheeled rolling walker, to a rolling walker it can be logically assumed that is requires less energy expenditure and allows for increased walking speeds and an increased ambulation distance.

The use of supplemental oxygen during exercise training may allow for higher training intensities, but long-term effects are unknown.[25] Research does not support continuous long-term oxygen therapy to improve dyspnea in COPD with severe hypoxaemia.[25] For patients without severe resting hypoxaemia, ambulatory oxygen, provided for use during exertion, confers no benefits upon dyspnea.[25] Further, there is no evidence to support the use of supplemental oxygen for alleviation of dyspnea at rest, before or after exertion.[25]

The patient was admitted to the sub-acute facility on 2-3 liters of continuous supplemental oxygen. At week 3 the patient weaned from 2 liters to 1 liter of oxygen, and by week 4 the patient was completely weaned off of oxygen. At week 4 the patient started to utilize a 4-wheeled walker which as previously stated, requires less energy expenditure and could have played a role in decreased supplemental oxygen use.

This study had two limitations. First, the medical records regarding the patient's acute hospitalization prior to the sub-acute facility were readily available. Second, the nursing reports of the timing of medications and doses were not available for review.

The lack of standardized procedures for determining the level of assistance required for bed mobility, transfers, and gait grading scales weakens the data's validity and reliability. Strengths of the data collected throughout this study include the inter- and intra-rater reliability, the test-retest reliability, and sensitivity of the Tinetti Balance Assessment. Another strength of the study is the data collected from the 30 Second Sit-to-Stand test, which had excellent test-retest reliability, inter-rater reliability, criterion validity, and construct validity.

In conclusion, this case report demonstrated that it is possible to improve the functional independence in male older adults with complex medical issues, which have had a diagnosis of hospital-acquired pneumonia following 3.5 weeks in acute-care and 11 days in the ICU. Physical therapy interventions within a sub-acute setting may have had an impact on the improvement of the patient's functional independence at discharge. This case study could have incorporated additional interventions and standardized tests to evaluate the patient's quality of life and dyspnea level throughout therapy. Additional interventions pertaining to the occupational therapy sessions and its impact on functional independence could have been implemented. Additional tests would include the SF-36 survey and the San Diego Shortness of Breath Questionnaire. As previously stated there has been no research comparing a 4-wheeled rolling walker to a rolling walker, and that it can be logically assumed that is requires less energy expenditure and allows for increased walking speeds and an increased ambulation distance. Future research should focus on comparing the energy expenditure of utilizing a rolling walker versus a 4-wheeled walker.

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